Syo KUROKAWA* and Heinai SHIBUICHI**: **Notes on Japanese species of *Pilophoron***

黒川 逍*・四分一平内**: 日本産カムリゴケ属について

(Pl. III)

*Pilophoron*, a genus of the Stereocaulaceae, comprises about 10 species, which are mostly distributed in alpine or subalpine regions in the world. In 1941, when Sato summarized Japanese *Pilophoron*, he reported the occurrence of three species of the genus in Japan; *P. aciculare* (Ach.) Nyl., *P. japonicum* Zahlbr. (=*P. hallii* (Tuck.) Vain.), and *P. nigricaule* Sato. In 1940, he published another paper on the genus, in which he proposed a new infrageneric classification for the genus, establishing the section Nigricaulia.

We have studied chemical substances of Japanese species of *Pilophoron* both with the microchemical and thin layer chromatographic methods. The results of chemical testings will be reported in this paper. A new species, *P. curtulum*, will be described, with special reference to infrageneric classification of the genus. Specimens cited in this paper are preserved at TNS, unless otherwise indicated. Our sincere thanks are expressed to Dr. H. Krog, University of Oslo, for the loan of valuable specimens of *P. cereolus* (Ach.) Nyl.

**Methods of chemical testing** Specimens of *Pilophoron* preserved at TNS were tested both with the microchemical and thin layer chromatographic methods. Atranorin, stictic acid, caperatic acid, and zeorin were crystalized on slide glasses following the ordinary microcrystal methods, but these substances, especially zeorin, were not always demonstrated in some specimens, probably because of the low concentration. Thin layer chromatographic tests were also made for these substances, for they seem to be more sensitive to various substances. The acetone extract was spotted on Merck's silica gel coated slide glasses (5×10 cm). The chromatograms were developed

* Department of Botany, National Science Museum, Tokyo. 国立科学博物館植物研究部.
** Kumagaya Girls' High School, Kumagaya, Saitama Pref. 埼玉県熊谷市熊谷女子高等学校.

Table 1. Chemical ingredients of Japanese *Pilophoron* demonstrated with thin layer chromatography.

| chemical substance | Rf value | color on chromatograms |
|---|---|---|
| stictic acid | 0. 08 | orange yellow |
| constictic acid | 0. 10 | dark grey |
| caperatic acid | 0. 24 | grey |
| Pil-1 | 0. 30 | pinkish violet to purple |
| Pil-2 | 0. 32 | pinkish violet to purple |
| zeorin | 0. 34 | pinkish violet to purple |
| Pil-3 | 0. 36 | pinkish violet to purple |
| atranorin | 0. 69 | orange yellow |
| Pil-4 | 0. 69 | pinkish violet |
| Pil-5 | 0. 72 | pinkish violet |
| Pil-6 | 0. 85 | pale grey |

with a mixture of *n*-hexane, ethyl ether, and formic acid (5 : 4 : 0.5) for about 6 minutes. After evaporation of the solvent, the chromatograms were sprayed with 10% sulphuric acid and heated over an alcohol flame. Substances detected with this methods are shown on the Table 1.

Stictic acid, constictic acid, caperatic acid, zeorin, and atranorin were identified by comparison with acetone extracts of other lichens which contain these substances. An orange yellow spot at Rf 0.08 and a dark grey spot at Rf. 0.10 are identified with stictic and constictic acids respectively, because these spots coincide with spots of the substances contained in *Menegazzia pertusa* (Shrank) Stein., *Stereocaulon japonicum* Th. Fr., and *Parmelia crinita* Ach. A grey spot at Rf 0.24 agrees with that of caperatic acid demonstrated on chromatograms of acetone extracts of *Parmelia caperata* (L.) Ach., *P. koyaensis* Asah., and *Platismatia interrupta* Culb. et Culb. Pure samples of zeorin and atranorin appear as a pinkish violet to purple spot at Rf 0.34 and an orange yellow spot at Rf 0.69 respectively. The other six spots have not yet been positively identified with any known substances; pinkish violet to purple spots at Rf 0.30, Rf 0.32 and Rf. 0.36, pinkish violet spots at Rf. 0.69 and 0.72 and pale grey spot at Rf. 0.85. These substances will be called Pil-1 (Rf 0.30), Pil-2 (Rf 0.32), Pil-3 (Rf 0.36), Pil-4 (Rf 0.69), Pil-5 (Rf 0.72) and Pil-6 (Rf 0.85) in this paper. Judging from color of spots, they appear

to belong to triterpenes. Pil-2 and Pil-3 give the same Rf values and color as those of pure samples of N-3 ($6\alpha$, $16\beta$-di-O-acetyl-leucotyline) and N-2 (6-deoxy-$16\beta$-O-acetyl-leucotyline), when chromatograms are developed with a mixture of *n*-hexane, ethyl ether, and formic acid, which has been used in this study. However, these spots can not be identified with N-3 or N-2, because no spot agrees with those of N-3 and N-2 on chromatograms developed with mixtures of benzene, dioxane, and acetic acid (25 : 10 : 1) or benzene, ethyl ether, and formic acid (50 : 20 : 1). The table 2 shows substances demonstrated in each species of *Pilophoron* with the chromatographic methods.

**Infrageneric classification** Sato (1940) divided *Pilophoron* into two sections, section Eupilophoron and section Nigricaulia. According to him, section Eupilophoron is characterized by colorless hyaline axis, whereas section Nigricaulia by black carbonized axis. As pointed out by Sato, *P. nigricaule*, the type species of section Nigricaulia, has black carbonized axis, which is connected with black carbonized excipulum at the uppermost portion. In contrast, the axis is colorless and hyaline in most specimens of both *P. aciculare* and *P. hallii*, which were considered as members of section

Table 2. Chemical ingredients of Japanese *Pilophoron*. Substances demonstrated with thin layer chromatographic methods are marked with + or trace, otherwise with −.

| species / substances | *P. aciculare* (Japan) | *P. aciculare* (North America) | *P. curtulum* | *P. hallii* | *P. nigricaule* |
|---|---|---|---|---|---|
| stictic acid | − | − | − | − | + |
| constictic acid | − | − | − | − | + |
| caperatic acid | − | − | − | + | − |
| Pil-1 | − | + | − | − | − |
| Pil-2 | trace or − | − | − | + or − | trace or − |
| zeorin | + | + | + or − | + | + or trace |
| Pil-3 | − | − | trace or − | + | trace or − |
| atranorin | + | + | + | + | + |
| Pil-4 | − | − | − | + | − |
| Pil-5 | − | − | − | + | − |
| Pil-6 | − | − | − | − | + |

Eupilophoron by Sato. The excipulum, however, is dark brown or black in all specimens of these two species. In one specimen of *P. hallii* collected at open alpine area on Mt. Eboshi, central Japan, in addition, the axis is apparently dark brown and is connected with dark brown excipulum, just as in the case of *P. nigricaule*. In *P. curtulum*, a new species, the axis is usually dark brown or blackish brown, especially when the axis is exposed. However, it is colorless and hyaline in some specimens of *P. curtulum*. Therefore, the color of axis seems to vary with environmental factors or exposure to sun-light. As a result, blackened axis appears to have no consistent value as an infrageneric character. Thus we do not feel it is necessary to devide the genus *Pilophoron* into sections, especially based on the color of axes.

**Pilophoron** (Tuck.) Th. Fr., Stereoc. et Pilophor. Comment. 40. 1857.

*Stereocaulon* section Pilophoron Tuck., Proc. Am. Acad. Arts Sci. **1**: 238, 1847.

*Pilophoron* section Eupilophoron Sato, Journ. Jap. Bot. **16**: 175, 1940. Type species: *Pilophoron aciculare* (Ach.) Nyl.

*Pilophoron* section Nigricaulia Sato, Journ. Jap. Bot. **16**: 175, 1940. Type species: *Pilophoron nigricaule* Sato.

Key to the species of Japanese *Pilophoron*

1. Fertile podetia more than 2 cm high; sterile ones sometimes less than 2 cm high and often sorediate; axis fistular at least near the base......... ..........................................(1) *P. aciculare* (Ach.) Nyl.
1. Podetia less than 1.5 cm high, esorediate; axis generally solid or composed of loosely interwoven hyphae.
   2. Thallus thick (0.8–1.5 mm), irregularly cracked and distinctly areolate; surface of podetia also cracked and areolate; podetia P+orange red, containing stictic acid..........................(4) *P. nigricaule* Sato
   2. Thallus thin (less than 1 mm), scabrous or granular; surface of podetia smooth but sometimes decorticate in part; podetia P−, not containing stictic acid.
      3. Apothecia ellipsoidal; caperatic acid present ...................... ........................................ (3) *P. hallii* (Tuck.) Vain.
      3. Apothecia globose; caperatic acid absent ......................... ... ...........................(2) *P. curtulum* Kurok. et Shibuichi

(1) **Pilophoron aciculare** (Ach.) Nyl., Mém. Soc. Sci. Nat. Cherboug 5: 96. 1857.

Basionym: *Baeomyces acicularis* Ach., Meth. Lich. 328. 1803.

This species is characterized by having very tall podetia and fistular axis. While fertile podetia are tall (usually more than 2 cm high) and esorediate, sterile ones are often sorediate and much shorter (less than 2 cm high). Specimens with sterile sorediate podetia may be confused with *P. cereolus*. However, podetia of *P. cereolus* are more densely sorediate and have almost solid axis.

In *P. aciculare*, cephalodia are scattered on the thallus as well as on podetia and are more or less densely distributed around the base of podetia. They are dark brown and 1.5–2 mm in diameter. Cortex of the cephalodia is more or less distinct and 15–25 $\mu$ thick. Blue green algae in the cephalodia belong to *Stigonema*.

Atranorin and zeorin were demonstrated in all specimens examined with thin layer chromatography. Pil-2, however, was demonstrated in small amout in only four specimens of 21 collections. It seems, therefore, to be an accessary component in this species. Although North American and Japanese specimens are identical in morphology, Pil-1 has never been demostrated in Japanese specimens, whereas it seems to be a constant component in North American ones (Table 2).

*Pilophoron aciculare* is apparently related to *P. cereolus*, because they both have similar tall podetia and produce similar substances. However, the axis is fistular in *P. aciculare*, while it is composed of loosely interwoven hyphae even in the center in *P. cereolus*. Podetia of *P. cereolus*, in addition, are densely sorediate even when fertile, whereas only sterile podetia are often sorediate in *P. aciculare*. Chemical products of *P. cereolus* are identical with those of Japanese specimens of *P. aciculare*. However, Pil-2, an accessory component in *P. aciculare*, has never been demonstrated in *P. cereolus*.

*Pilophoron aciculare* is distributed mainly in subalpine areas in Japan, growing on non-calcareous rocks. It has been also reported from North America, southern Africa, and Australia.

Exsiccatae examined. Krypt. Exs. Vindobonensi 2842, 4140 (*sub Pilophorus cereolus*), and 4228. Kurokawa, Lich. Rar. Crit. Exs. 95.

Specimens examined. JAPAN. HONSHU. Prov. Musashi: Chichibu, Y. Asahina (2 specimens). Mt. Kobushi, Y. Asahina. The same, H. Shibuichi

1644 and 1645. Prov. Shinano: Mt. Tadeshina, S. Kurokawa 51718 and 51719. Yatsugatake Mts., Y. Asahina (4 specimens). The same, Yabe. The same, S. Kurokawa 51133 and 58414 (B, DUKE, LD, M, MEL, TNS, UPS, US). Mt. Kobushi, S. Kurokawa 520850 and 540300. Mt. Kokushi, S. Kurokawa 520104. Azusayama, S. Kurokawa 59165 (B, BKF, CAN, DUKE, TNS, US). Mt. Kisokomagatake, Y. Asahina. Prov. Kai: Mt. Howo, Y. Okada. U. S. A. Washington: Clallam Co., Herre. CANADA. British Columbia: Mt. Buxton, Schofield & Williams 27918. Egmond, S. Shibata.

(2) **Pilophoron curtulum** Kurok. et Shibuichi, sp. nov.

Thallus primarius crustaceus, substrato arcte adhaerens, glaucus, minutissime rimosus granulatusque, sorediis et isidiis destitutus, cephalodiis fusco-brunnescentibus et ex granulis minutissimis formatis praeditus. Podetia plus minusve dispersa, cylindrica, erecta vel suberecta, simplicia, curtula, 3–5 mm alta, 0.5–1.0 mm crassa; superficies podetii corticata sed raro decorticata, plus minusve granulata; axis fusco-brunnescens sed raro decoloratus, ex hyphis longitudinalibus conglutinatibusque formatus, sed in centro axis hyphis plus minusve laxe intricatis. Apothecia terminalia, simplicia, plerumque globosa, nigra, 0.8–1.2 mm diametro; epithecium indico coloratum; hymenium hyalinum, ca. 100 $\mu$ altum, J+coerulescens; hypothecium una cum excipulo fuscescens; asci elongato-clavati; sporae 8-nae, simplices decolorataeque, fuciformes vel ellipsoideae, $5–7 \times 20–25\ \mu$.

Reactions: thallus and podetia K+pale yellow, C−, P−.

Chemical ingredients: atranorin as a constant component and zeorin and Pil-3 present or absent.

Type collection: Mt. Ontake, Prov. Hida, Japan. On rocks, elevation 1900–2800 m. S. Kurokawa 64180——holotype in TNS and isotypes in FH and O.

This new species has been long confused with *P. hallii* by Japanese lichenologists, because they both occur mainly in subalpine areas in Japan and have similar thalli and podetia. However, it is clearly distinguished from *P. hallii* by having more rounded apothecia and by lacking caperatic acid. The axis of this species is more often dark brown than in *P. hallii*. Thus, it also may be confused with *P. nigricaule*, from which it is easily separated by the thinner thalli and a negative reaction with P. While atranorin is a constant component in this species, zeorin seems to be an accessory, being demonstrated in only three of 15 specimens. This species is rather common

in subalpine areas in Japan, often growing together with *P. hallii*.

Specimens examined. HOKKAIDO. Prov. Ishikari: Mt. Furano, S. Kurokawa 65412. HONSHU. Prov. Mutsu: Mt. Hakkoda, S. Kurokawa 64249. Prov. Rikuchu: Mt. Hayachine, S. Kurokawa 59282. Prov. Iwashiro: Azuma Mts., S. Kurokawa 58174. Prov. Etchu: Mt. Tateyama, Y. Asahina 602. Prov. Shinano: Shiga-kogen, M. Togashi. Mt. Eboshi, H. Shibuichi 3457. Mt. Norikura, Y. Asahina 39073 and 39073-a. Yatsugatake Mts., A. Yamamoto. Prov. Hida: Mt. Ontake, Togashi & Kurokawa 54085. The same, S. Kurokawa 64144, 64152, 64162, and 64180.

(3) **Pilophoron hallii** (Tuck.) Vain., Bot. Mag. Tokyo **35**: 59. 1921.

Basionym *Pilophoron aciculare β hallii* Tuck., Proc. Amer. Acad. Arts Sci. **12**: 177. 1877.

Atranorin and zeorin were demonstrated in all specimens of *P. hallii* with both microchemical and thin layer chromatographic methods. The presence of caperatic acid, in addition, was proved in all specimens of this species with thin layer chromatographic methods, though the acid was demonstrated in most specimens with crystal methods with some difficulty. This is the first record of the occurrence of a fatty acid in the genus *Pilophoron*. Some other substances were also demonstrated in this species with the chromatographic methods. Pil-3, Pil-4, and Pil-5 were demonstrated in all specimens, but Pil-2 in 44 of 58 specimens.

This species was known as *P. japonicum* Zahlbr. in Japan. Recently, however, Sato (1962) pointed out that the name *P. hallii* should be used for this species. As mentioned above, *P. hallii* is related to *P. curtulum* and the difference between these two species was discussed under *P. curtulum*.

*Pilophoron hallii* is widely distributed in temperate and subalpine areas in Japan. It also has been reported from Korea and North America. In addition, two specimens collected in Taiwan are identical with this species. Thus, *P. hallii* shows a disjunctive distribution between eastern Asia and North America.

Exsiccatae examined. Asahina, Lich. Jap. Exs. 39 (*sub P. japonicum*).

Specimens examined. JAPAN. HOKKAIDO. Prov. Ishikari: Mt. Tomuraushi, Y. Asahina. Mt. Furano, S. Kurokawa 64413. Prov. Kushiro: Mt. O-Akan, S. Kurokawa 65682. HONSHU. Prov. Mutsu: Mt. Hakkoda, S. Kurokawa 64232. Prov. Rikuchu: Mt. Hayachine, S. Kurokawa 67045. Prov.

Shimotsuke: Konsei Pass, Y. Asahina (2 specimens). Mt. Nyoho, Nikko, Fujikawa. Mt. Shirane, Nikko, Ochiai 183. Prov. Musashi: Chichibu, Y. Asahina. Mt. Mitsumine, Y. Asahina 37. The same, H. Shibuichi 1717. The same, S. Kurokawa 510102. The same, Komiya 36. Mt. Kumotori, H. Shibuichi 2587, 2588, and 3766. Prov. Sagami: Hakone, Y. Asahina 107. The same, M. Ogata 31. The same, S. Kurokawa 58047. Prov. Sado: Mt. Kimpoku-san, M. Togashi. Prov. Echigo: Mt. Naeba, S. Kurokawa 57196 and 57216. Prov. Etchu: Makawa, Y. Asahina. Mt. Tateyama, Y. Asahina 39. The same, S. Kurokawa 50010. Prov. Shinano: Mt. Eboshi, S. Kurokawa 520258. The same, H. Shibuichi 3450. Shigakogen, M. Togashi. Yatsugatake Mts., Y. Asahina 92. The same, S. Kurokawa 51134, 58223, and 65034. Mt. Kimpu, S. Kurokawa 65292. Azusayama, S. Kurokawa 59164 (M, TNS, US). Mt. Kobushi, S. Kurokawa 520847. Mt. Kiso-Komagatake, Y. Asahina 31. The same, H. Shibuichi 3957, 3958, and 3959. Prov. Suruga: Mt. Shomugen, H. Shibuichi 3601, 3602, 3603, 3604 and 3605. Prov. Izu: Mt. Amagi, Y. Kobayasi. The same, Y. Asahina 117. Amagi Pass, Komiya 121. Prov. Kii: Kowadani, S. Kurokawa 59062. Yanoko Pass, S. Kurokawa 59106 (LD, TNS). SHIKOKU. Prov. Iyo: Mt. Onigajo, S. Kurokawa 550139. Prov. Tosa: Mt. Ohdo-yama, Fujikawa. KYUSHU. Prov. Bungo: Mt. Yufu-dake, S. Kurokawa 62260. Mt. Sobo-san, S. Kurokawa 63178. Prov. Higo: Mt. Ichibusa, S. Kurokawa 63109. Prov. Ohsumi: Mt. Kurino-dake, Taniguchi 16. Yakushima Island, Fujikawa (2 specimens). The same, M. Fujimoto & H. Idzumi. FORMOSA. Prov. Taipei: Mt. Shichisei, Sasaki 33. Prov. Chiayi: Mt. Shinkao-san, S. Kurokawa 318.

(4) **Pilophoron nigricaule** Sato, Journ. Jap. Bot. **16**: 173. 1940.

Type collection: Mt. Gassan, Prov. Uzen. Japan. Aug. 25, 1932. M. Sato——holotype in TI.

This species resembles *P. curtulum*, because they both have rather short podetia, globose apothecia, and dark brown axis. However, it is easily separated from *P. curtulum* by thicker thalli and orange color reaction with P. While the cortex of cephalodia is thin (15–20 $\mu$) and indistinct in *P. curtulum*, it is rather thick (20–25 $\mu$) and distinct in *P. nigricaule*.

Even though Sato reported negative reaction with P, the thallus and podetia are apparently P+orange red in the holotype of *P. nigricaule*, containing stictic acid. Krog (1968) recently reported the presence of atranorin, stictic acid and zeorin in an Alaskan specimen of this species. The results

of thin layer chromatographic tests show the presence of constictic acid and Pil–6 in this species along with atranorin, stictic acid, and zeorin. In addition, Pil–2 was demonstrated in seven of 17 specimens and Pil–3 in ten of 17 specimens.

*Pilophoron nigricaule* is distributed in open alpine areas in central and northern Japan. Although it had been long considered to be endemic to Japan, Krog (1968) reported the occurrence of this species in Alaska. Thus, the range now includes Alaska and Japan, even though the species has been reported neither from Kuriles nor from Hokkaido.

Specimens examined. JAPAN. HONSHU. Prov. Etchu: Mt. Tateyama, Y. Asahina 601. The same, S. Kurokawa 50008. Mt. Taro, Y. Asahina. Prov. Shinano: Mt. Hakuba-Norikura, Y. Asahina (3 specimens). Mt. Suisho-dake, S. Kurokawa 520711. Mt. Yarigatake, S. Kurokawa 520452. Mt. Norikura, Y. Asahina. Mt. Kiso-komagatake, Y. Asahina 18–a and 18–b. The same, H. Shibuichi 3760, 3878, 3879, 3880 and 3881. The same, S. Kurokawa 69001.

## Literature cited

Krog, H. 1968. The macrolichens of Alaska. Norsk Polarinst. Skr. **144**: 1–180. Sato, M. 1940. East Asiatic Lichens III. Journ. Jap. Bot. **16**: 173–177. —— 1941. Cladoniales I. In Nakai et Honda, Nov. Fl. Jap. 105 pp. Tokyo. —— 1962. *Pilophoron japonicum* Zahlbr. is a synonym of *P. hallii* Vain. Misc. Bryol. Lichenol. **2**: 162.

## Explanation of Plate III

Fig. 1. Holotype of *Pilophoron nigricaule* Sato (×5). Fig. 2. Part of holotype of *Pilophoron curtulum* Kurok. et Shibuichi (×6). Fig. 3. The same (×12).

* * * *

日本のカムリゴケ属については佐藤正己博士 (1940, 1941, 1962) がすでに論説を発表しておられ，3種が知られている。すなわち，カムリゴケ (*P. hallii*)，オオカムリゴケ (*P. aciculare*)，マルミカムリゴケ (*P. nigricaule*) である。カムリゴケに似ているが，成分が異なり，子柄の軸がしばしば暗褐色をおびるものを新種として加え，これをカムリゴケモドキ (新称) (*P. curtulum*) とした。これら4種について，結晶

法と薄層クロマト法によって化学成分を検査して，その結果を第2表に示した。また佐藤博士は本属をカムリゴケ節 (sect. Eupilophoron) とマルミカムリゴケ節 (sect. Nigricaulia) に分けることを提唱された。しかしその根拠となった子柄の軸の色や，軸をつくる菌糸の密度にはかなり個体変異が見られ，とくにカムリゴケモドキは両節の中間型を示すので，ここでは佐藤博士の分類方式をとらなかった。

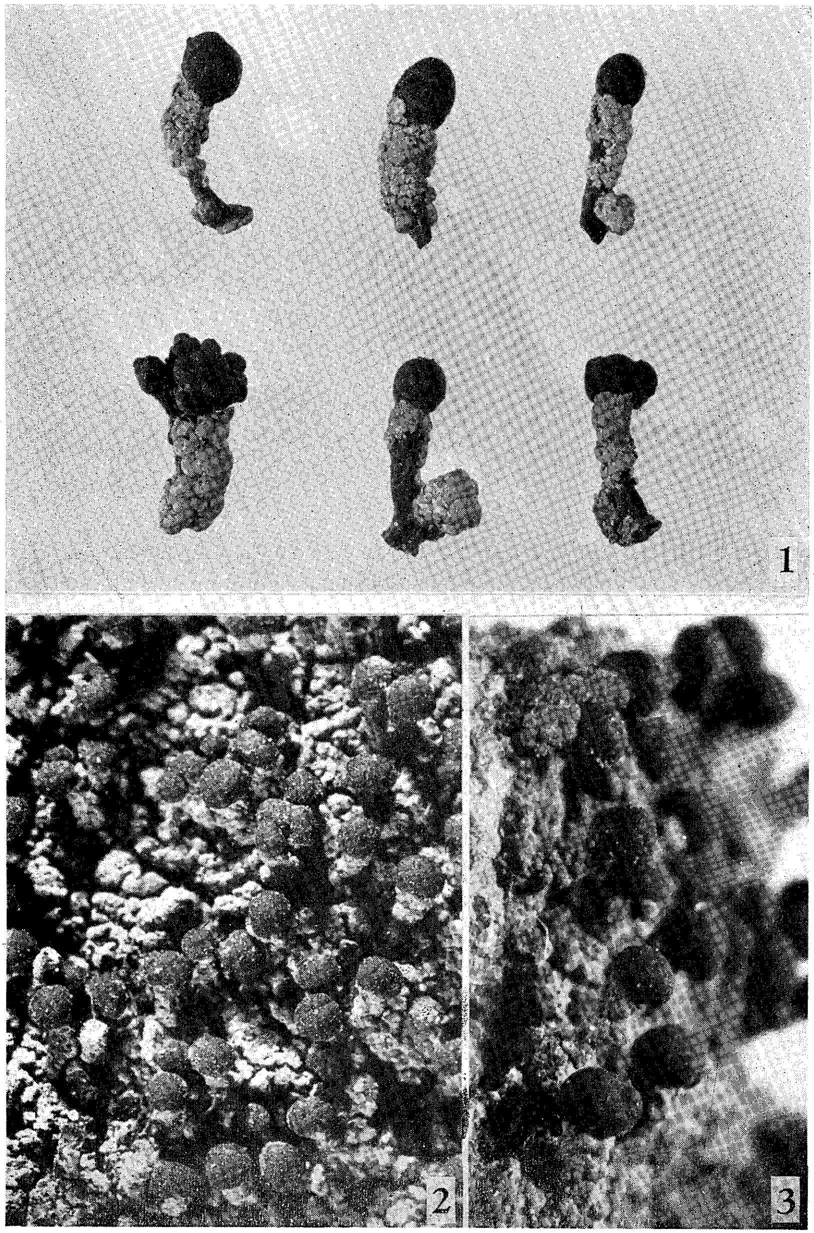
---

**○外来植物の人為的散布の一例** (浅井康宏) Yasuhiro Asai: On the *Solidago canadensis* group widely spread by bee-keepers in Japan.

近年，我国各地から外来のアキノキリンソウ属 *Solidago* の爆発的な繁殖，広分布が報ぜられている。その正確な種名の検定については，今後全国的な規模で種々な観点から検討を要するが，いずれにしてもこの大形の *Solidago* の仲間が第2次大戦後にどのようにして急激に拡がり，特に市街地周辺の荒蕪地やそれに近接した丘陵地帯に生育して，大群落を形成するに至ったかについては，外来植物調査上，誠に興味ある事実と云わねばならない。勿論我国に現在渡来している *Solidago* は，その他の外来植物に比較して草丈も高く，繁殖力も大きく，しかも開花期には米名 Goldenrod の名にそむかぬ鮮黄色の花穂を一面に波うたせ，群生地の景観を一変させる極めて目立った存在であることも，この仲間が一般的に注目される所以であろう。

従来本種の分布原因としては，その観賞価値に伴う人為的な移植及び地下茎による旺盛な繁殖力などが挙げられていたが，しかしそれにも自から限度があり，その新地域（特に都市周辺の原野，堤防，荒蕪地など）への，この大形植物の移動，分布要因について，筆者は少なからず疑問と興味とを抱いていた次第である。ところが頃日，はからずもその一因とも云える事実を知り得たので，ここに記録し同学諸氏の御参考に供し度いと思う。ご承知のように養蜂家にとって，いわゆる蜜源植物は蜂蜜の生産に随伴して欠くことの出来ない存在である。しかしながら近年，我国の自然の破壊及び都市周辺の農耕地の宅地化は，実にめざましいものがあり，これに伴ないいわゆる蜜源植物が年々極度に減少の一途を辿りつつあることは周知の事実である。そこで，これに対応するため，養蜂家は蜜源植物の増殖と獲得にのり出し，種々努力を続けているが，この一環として現在各地で話題となりつつある外来の *Solidago* がクローズアップされて来たものである。

蜜源植物となるためには種々の条件（増殖率や適応性が大きく，多数のものが一個所にまとまって生育し，一時に多量の花蜜を供給し得ること，及び開花が長期に亘ることなど）が必要であるが，この中でも晩秋まで開花し，しかも前述の諸条件をも可成り充たすものとして本種が着目された次第である。その結果，日本蜂蜜協会の指導者がこれを取り上げ，これを各地へ増殖するよう配慮したものである。これに呼応して関係者（全国で約1万人の協会員のうち，数千人がこれに関与したと云う）は，極めて




KUROKAWA & SHIBUICHI: Japanese species of *Pilophoron*.